

July 12, 1949.

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2,476,061

LOOP-TAKER MECHANISM FOR SEWING MACHINES

Filed July 6, 1946

4 Sheets-Sheet 1

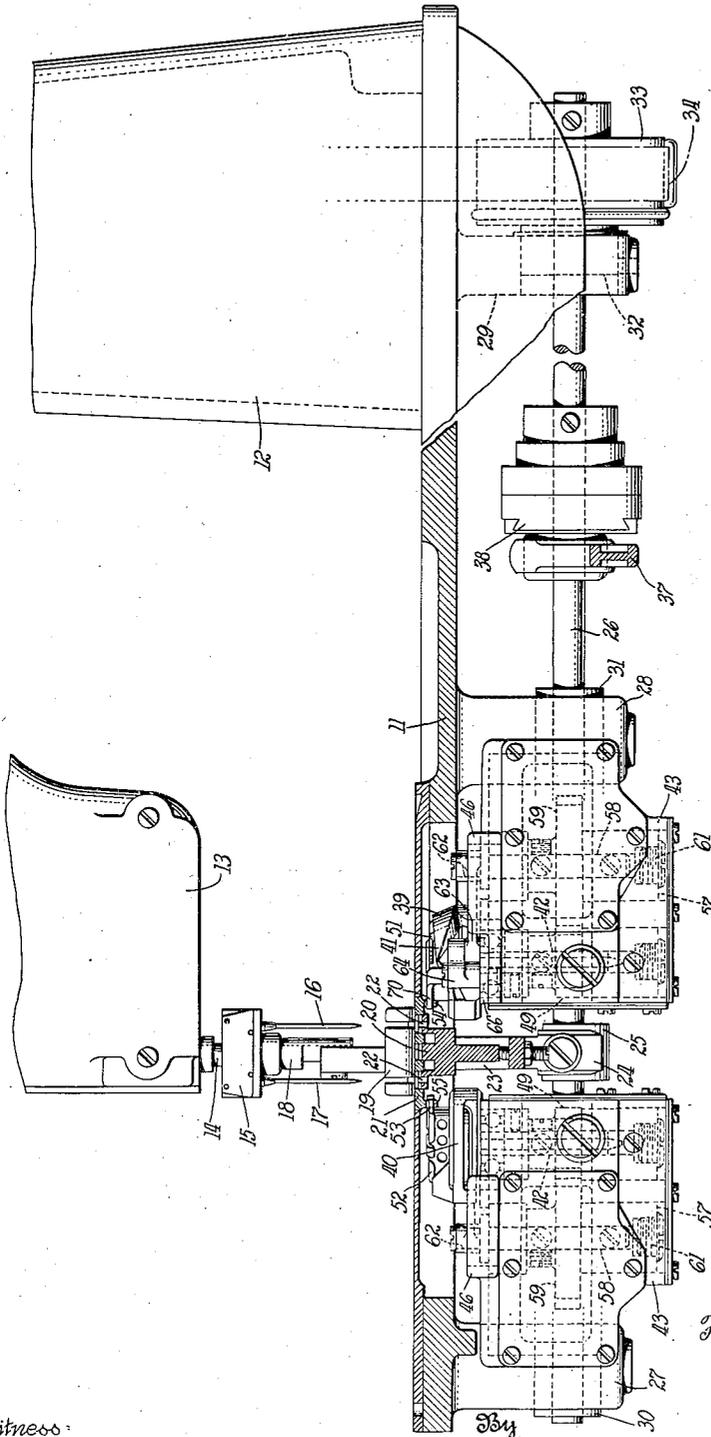


Fig. 1.

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4 Sheets-Sheet 2

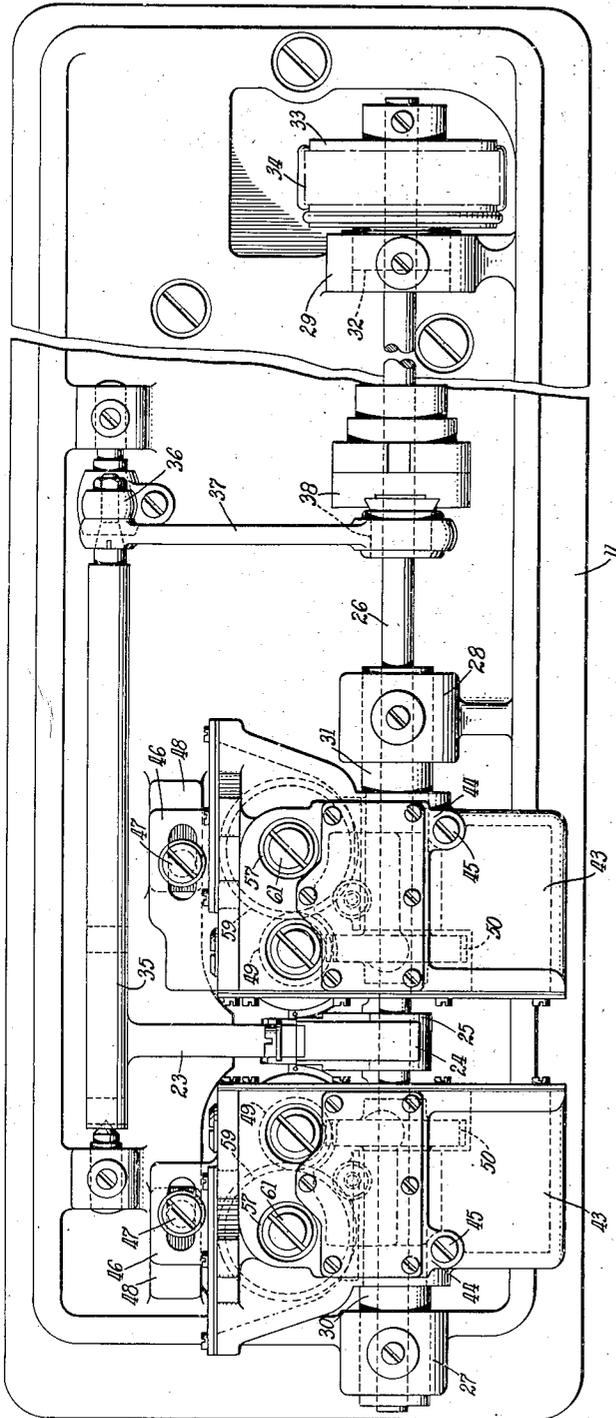


Fig. 2.

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4 Sheets-Sheet 3

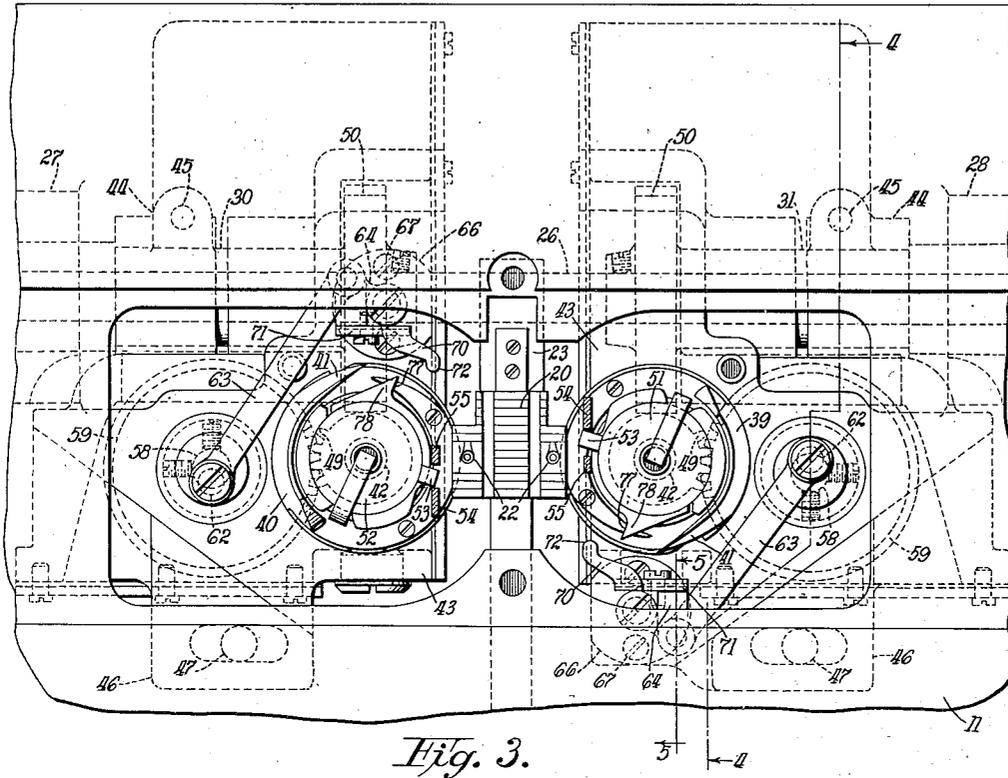


Fig. 3.

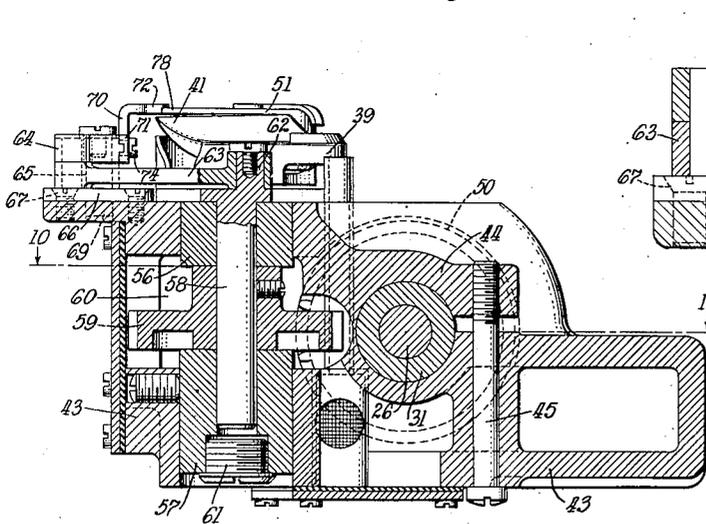


Fig. 4.

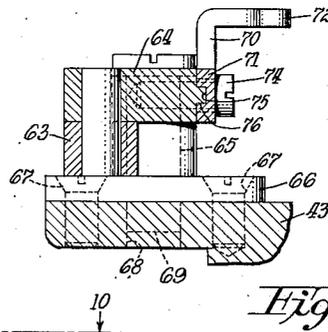


Fig. 5.

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4 Sheets-Sheet 4

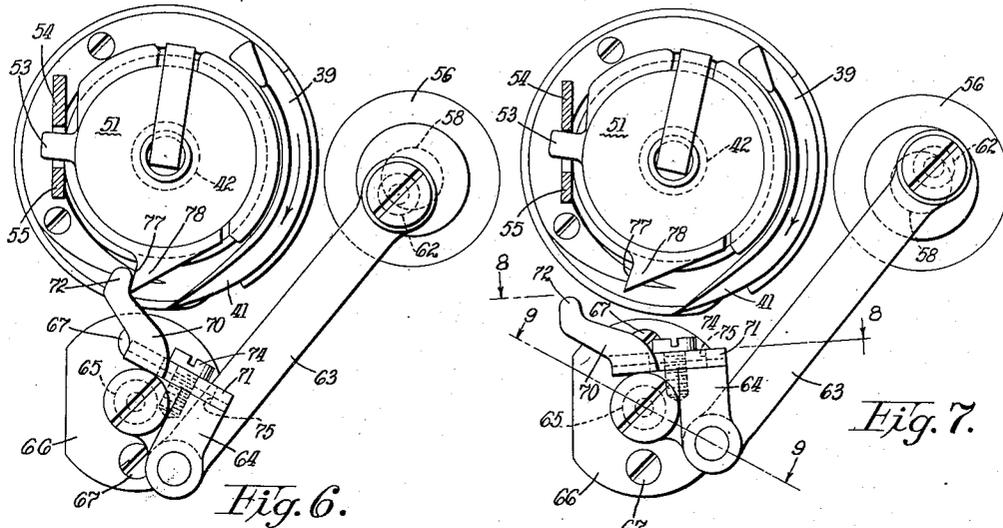


Fig. 6.

Fig. 7.

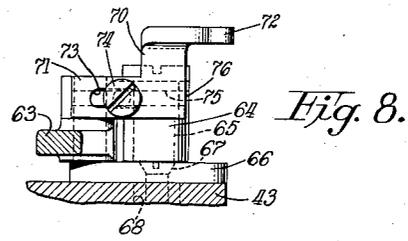


Fig. 8.

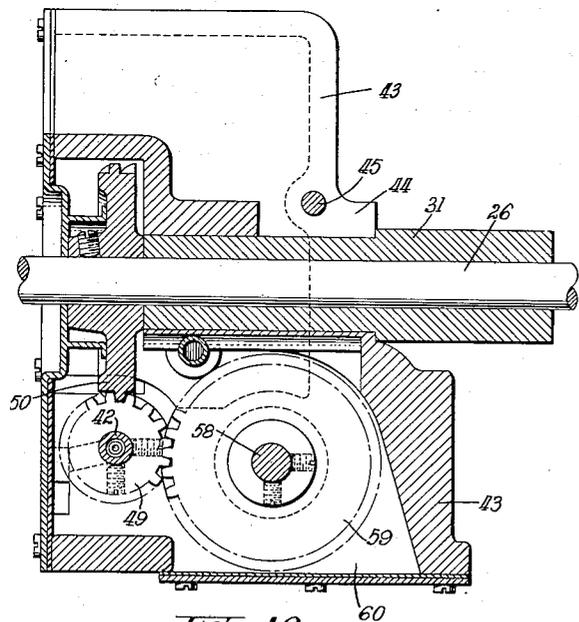


Fig. 10.

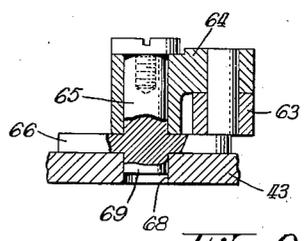


Fig. 9.

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UNITED STATES PATENT OFFICE

2,476,061

LOOP-TAKER MECHANISM FOR SEWING MACHINES

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Application July 6, 1946, Serial No. 681,639

15 Claims. (Cl. 112—184)

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This invention relates to lock-stitch sewing machines of the type employing a rotary loop-taker for casting needle-thread loops about a thread-carrier or -case journaled in and restrained against rotation with the loop-taker. More particularly, the present invention relates to mechanisms commonly referred to as "mechanical openers."

The present invention has for its primary object to provide an improved construction for effecting an unobstructed passage for the needle-thread loops around the thread-carrier of a rotary hook type of loop-taker, insofar as the needle-thread loops would meet with interference or resistance by the rotation-restraining means employed for preventing rotation of said thread-carrier with said rotary loop-taker.

Another object of the present invention is to provide the hook-saddle of a lock-stitch machine with a "built-in" mechanical opener having simple and compact actuating mechanism.

A further object of this invention is to provide a mechanical opener entirely sustained by the usual hook-saddle and deriving its actuation from the hook-shaft.

A still further object of the present invention is to provide a mechanical opener supported by the usual hook-saddle and arranged so that its drive is accomplished through gearing disposed within the cavity containing the gear-drive between the bed-shaft and the hook-shaft.

With these and other objects in view, as will hereinafter appear, the invention comprises the devices, combinations and arrangements of parts which will be described in connection with the accompanying drawings, illustrating a preferred embodiment of the invention and in which:

Fig. 1 is a front elevation, partly in vertical section, of a sewing machine equipped with the present invention.

Fig. 2 is a bottom plan view of the sewing machine shown in Fig. 1.

Fig. 3 is an enlarged top plan view of a portion of the machine bed-plate, with the bed-slides removed and the thread-carrier stops of the throat-plate shown in section, better to expose the loop-takers.

Fig. 4 represents a vertical sectional view taken substantially along the line 4—4, Fig. 3.

Fig. 5 represents a vertical sectional view taken substantially along the line 5—5, Fig. 3.

Fig. 6 is an enlarged top plan view of the rotary loop-taker and that portion of the mechanical opener mechanism exposed on top of the hook-

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saddle, showing the mechanical opener in its advanced or effective position in which the thread-carrier has been reversely turned so that its rotation-restraining nose or lug is disposed midway between the thread-carrier stops, which are shown in section, thereby to provide an unobstructed free passage for the needle-thread loop.

Fig. 7 is a view similar to Fig. 6, but with the mechanical opener at its extreme retracted or ineffective position, the thread-carrier rotation-restraining lug urged into contact with one of the thread-carrier stops by the rotation of the loop-seizing element of the loop-taker.

Fig. 8 is a vertical sectional view taken substantially along the line 8—8, Fig. 7, illustrating the way in which the opener-finger is adjustably secured to its carrier.

Fig. 9 is a vertical sectional view taken substantially along the line 9—9, Fig. 7, showing the manner of mounting the opener-finger carrier fulcrum-stud on the hook-saddle.

Fig. 10 is a horizontal sectional view taken substantially on the line 10—10 of Fig. 4.

As shown in the drawings, the present invention has been embodied in a two-needle lock-stitch sewing machine. This machine has a frame comprising a work-support or bed 11 from one end of which rises a standard 12 of a bracket-arm terminating at its free end in a head 13 overhanging the work-support 11. Journaled for endwise reciprocation within the bracket-arm head 13 is a needle-bar 14 carrying at its lower end a needle-clamp 15. Secured in the needle-clamp 15 are two needles 16 and 17 spaced from each other lengthwise of the work-support 11. Also journaled for vertical movement in the head 13 is a spring-depressed presser-bar 18 carrying at its lower end a conventional presser-foot 19.

The material to be stitched is advanced across the work-support 11 by a feed-dog 20 operating through a suitably slotted throat-plate 21 and opposed in its work-engaging movements by the presser-foot 19. In the present machine, the feed-dog 20 is provided with clearance apertures 22 for the needles 16 and 17 which have imparted to them movement in the direction of feed while in the work to assist the feed-dog 20 in feeding the material.

The feed-dog 20 is secured on a feed-bar 23 having a fork 24 engaged by a feed-lift eccentric 25. The eccentric 25 is carried by the usual horizontally disposed bed-shaft 26 which is rotatably journaled in bearing lugs 27, 28 and 29 depending from the work-support 11. The bearing-

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lugs 27 and 28 are provided with bearing bushings 30 and 31, respectively, and the bearing lug 29 is provided with a ball-bearing 32 for the shaft 26. Adjacent the bearing lug 29, the bed-shaft 26 carries a pulley 33 driven by a belt 34 to rotate the shaft 26 once for each complete needle-reciprocation.

The feed-bar 23 is pivotally connected to a feed-advance rocker 35 suitably fulcrumed at the front side of and below the work-support 11. Operatively connected to a crank-arm 36 depending from the feed-rocker 35 is one end of a pitman 37 formed at its other end with a strap embracing a feed-advance eccentric 38 carried by the bed-shaft 26. The eccentric 38 is of conventional design and is adjustable as to eccentricity in order that the feed-advancing stroke can be regulated. The described feeding mechanism functions to impart the usual feed-lift and feed-advance movements to the feed-dog 20.

Complemental to the respective needles 16 and 17, in the formation of lock-stitches, are two loop-takers 39 and 40 disposed below the work-support 11 and comprising vertical-axis rotary hooks of conventional design. The rotary hooks 39 and 40 each has an upwardly open cup-shaped body provided in its side wall with a needle-thread loop-seizing and -spreading beak 41. Carrying the rotary hooks 39 and 40 are vertically disposed hook-shafts 42 journaled in the vertically spaced walls of the supporting brackets or saddles 43. These saddles 43 are each adapted to be supported beneath the work-support 11, and to that end each is provided with a split-boss 44 clamped by a screw 45 upon the bearing bushing 30 or 31 and a foot 46 secured by a screw 47 against the under face of a seat 48 (Fig. 2) milled on the work-support 11. The described securing means for the saddles 43 provides for adjustment thereof lengthwise of the work-support 11 i. e., for adjustment of the saddles 43 transversely of the direction of feed.

The hook-shafts 42 each has secured thereto a spiral pinion 49 meshing with a spiral driving gear 50 carried by the bed-shaft 26; the proportions of the gear 50 and pinion 49 being such that the rotary hooks rotate twice for each complete reciprocation of the needles.

Journalled in the respective rotary hooks 39 and 40 are thread-carriers 51 and 52 about which the needle-thread loops are cast by the rotary hooks. To prevent the thread-carriers from rotating with the rotary hooks, each of the carriers is provided with a nose 53 extending laterally from the carrier and entering a stop-notch formed by spaced stop-lugs 54 and 55 depending from the throat-plate 21. The stop-lugs 54 and 55 act to restrain the thread-carriers 51 and 52 from rotating with their respective hooks; the stop-lugs being spaced apart a distance greater than the width of the thread-carrier nose 53 so as to permit limited turning movements of the thread-carrier in opposite directions.

In order to provide thread-clearance space between the thread-carrier nose 53 and the stop-lug opposing rotation of the thread-carrier with the hook, there have been employed various expedients to turn the thread-carrier in an opposite direction; these expedients being commonly referred to as mechanical openers. In turning the thread-carrier so that its nose moves away from the stop-lug, an open unobstructed thread-passage is provided past the thread-carrier rotation-restraining means. The effect of the operation of the mechanical opener is

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clearly illustrated in Figs. 6, the nose 53 being moved to a position substantially midway between the stop-lugs 54 and 55, providing a free thread-passage on each side of the nose 53. In connection with vertical-axis rotary hooks, it has been the more general practice to provide thread-carrier engaging fingers actuated from eccentrics carried by the vertical hook-shafts. In a mechanical opener of this type, the opener-finger necessarily engages and oscillates or turns the thread-carrier a plurality of times for each stitch-formation; one of the turning movements of the thread-carrier being idle and performing no useful function. While this arrangement has the advantage of permitting employment of a small actuating eccentric for imparting a comparatively short movement to the opener-finger, and also permits the adjustment of the loop-taker saddle, the double action of the opener is a definite speed-limiting factor due to overheating of the parts at high speed operation of the machine. These double-acting devices are known as two-to-one mechanical openers.

It has also been the practice to actuate a mechanical opener, associated with a vertical axis rotary hook, from the bed-shaft which rotates once only for each stitch-forming cycle. These single-acting expedients are referred to as one-to-one mechanical openers. However, devices of this character have been more commonly employed in connection with sewing machines having only one rotary hook and more generally employing a spring-returned cam-follower unadapted to meet and to withstand the extreme high speed requirements. There have been other embodiments of the one-to-one mechanical opener in multiple-hook sewing machines, but these have been driven by a single eccentric on the bed-shaft of the machine. The single eccentric drive for a plurality of openers has the drawback of complicating individual timing of each opener. Also, when adjusting the hook-saddles to accommodate various needle spacings or gauges, the actuating connections for the opener-fingers must be adjusted to correspond to the position of the saddles.

The present invention aims to provide a mechanical opener of the one-to-one type which is particularly well adapted for multiple-needle sewing machines, and which is compactly built into the hook-saddle, whereby the saddles may be adjusted for various needle gauges without requiring a resetting of the openers. To this end, each saddle 43 (Fig. 4) is provided with upper and lower bearing bushings 56 and 57 in which is journaled a vertically disposed rotary opener-shaft 58. The opener-shaft 58 has mounted on it a spiral-gear 59 meshing with the hook-shaft pinion gear 49 (Fig. 10); the gear 59 being the same size as the spiral-gear 50 mounted on the bed-shaft 26 and, consequently, the opener-shaft 58 is rotated at the same speed as the bed-shaft. As shown in Fig. 10, the three meshing gears 49, 50 and 59 are all disposed within a common oil-chamber 60 provided in the hook-saddle 43 and, therefore, are adequately lubricated to sustain high speed operation. A plug 61 threaded into the lower end of the bushing 57 (Fig. 4) closes the shaft bearing against oil leakage.

The opener-shaft 58, at its upper end, is preferably formed with a crank-pin 62 embraced by one end of a link 63 connected at its other end to an opener-finger carrier 64. The opener-finger carrier 64 is supported for rocking or

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oscillatory movement on a fulcrum-stud 65 flanged, as at 66 (Fig. 9), for mounting by screws 67, on the top of the hook-saddle 43. To assist in anchoring the fulcrum-stud 65 in proper position on the hook-saddle 44, the saddle is apertured as at 68 (Fig. 9) to receive a locating-projection 69 depending from the bottom of the fulcrum-stud flange 66. The carrier 64 has fastened to it an opener-member or finger 70 having an offset shank 71 at one end and terminating at its free end in a rounded nose 72. The shank 71 is slotted, as at 73, to receive a clamping screw 74, whereby the opener-finger is adjustably mounted on the carrier 64. To maintain the adjustment of the opener-finger relative to its carrier 64 in a plane substantially normal to the axis of rotation of the loop-taker, the shank 71 is grooved, as at 75 (Fig. 5), to receive a tongue 76 provided on the carrier 64.

The opener-finger 70 is shaped to extend inwardly in the direction toward the axis of rotation of the rotary loop-taker and its rounded nose 72 is adapted to engage a substantially straight edge 77 of an ear 78 extending outwardly from the thread-carrier 51 or 52 to overlie the rim of the rotary hook 39 or 40. The edge 77 of the thread-carrier ear 78 preferably extends substantially radially from the thread-carrier to minimize cramping of the thread-carrier in its bearing by the action of the opener-finger 70 and, further, to permit a reduction to a minimum of the effective portion of the stroke of the opener-finger 70.

In the operation of the machine, the gear 59 rotates the opener-shaft 53 at the same speed as the bed-shaft 26. The crank-pin 62, through the link 63, imparts to the carrier 64 and opener-finger 70 oscillations of a constant amplitude; the amplitude of said oscillations being greater than necessary to effect the desired functioning of the mechanical opener. Therefore, it will be understood that not only is the opener-shaft 53 rotating at one-half the frequency of the rotary loop-takers, but that the opener-finger 70 has imparted to the thread-carrier a minimum of properly timed movement requisite to perform its function of separating the thread-carrier stops for the unobstructed passage of the needle-thread loops. It will be observed in Fig. 6, which shows the opener-finger in its advanced position in which the thread-carrier has been reversely turned so that its rotation-restraining lug 53 is disposed midway between the thread-carrier stops 54 and 55, that the axis of the crank-pin 62 is in substantial alinement with the axis of the opener-shaft 58 and the axis of the pivotal connection of the link 63 with the carrier 64. Since substantially no endwise movement is imparted to the link 63 while the crank pin 62 is turning through this aligned position, the opener-finger 70 dwells in its advanced position. This dwell effectively holds the thread-carrier rotation-restraining means separated sufficiently long to permit the needle-thread loop to pass unimpeded through the opening provided between the thread-carrier nose 53 and the throat-plate stop-lug 54.

It will be understood from the foregoing that I have devised a mechanical opener mechanism which is compact and capable of being completely embodied in the usual hook-saddle. The arrangement of the parts is such that they may be made small and light in weight; the rotating driving components of which can be easily and thoroughly lubricated. Also, since most of the

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mechanism is housed within the hook-saddle, the mechanism is simple and, moreover, has the appearance of simplicity, which fact is of importance in a demonstration of the machine. While I have shown the improved mechanical opener mechanism as applied to a two needle sewing machine, it will be obvious that most of its virtues still exist when the opener is embodied in a single needle machine.

While I have shown and described a construction best adapted for carrying out my invention, it is to be understood that it is susceptible of various modifications within the range of mechanical skill.

Having thus set forth the nature of the invention, what I claim herein is:

1. In a sewing machine, a reciprocatory needle, a loop-taker complementary to said needle in the formation of stitches and performing a plurality of rotations during each reciprocation of the needle, a shaft carrying said loop-taker, means for rotating said shaft, a gear on said loop-taker shaft, a thread-carrier journaled in said loop-taker, means for restraining rotation of said thread-carrier with said loop-taker, and a mechanical opener for providing a thread passage past said rotation-restraining means, said mechanical opener including a movable opener-member adapted to impart an oscillation to the thread-carrier in a direction opposite to the direction of rotation of the loop-taker, and means including a gear in mesh with the gear on said loop-taker supporting shaft for actuating said opener-member to oscillate the thread-carrier once for each needle reciprocation.

2. A sewing machine having a frame including a bed and a bracket-arm, an endwise reciprocatory needle journaled in said bracket-arm, a rotary loop-taker, a shaft carrying said loop-taker, a rotary actuating shaft journaled in said bed, gearing connecting said loop-taker shaft with said actuating shaft for rotating said loop-taker a plurality of rotations during each reciprocation of the needle, a thread-carrier journaled in said loop-taker, means for restraining rotation of said thread-carrier with said loop-taker, and a mechanical opener for providing a thread passage past said rotation-restraining means, said mechanical opener including a movable opener-member adapted to impart an oscillation to the thread-carrier in a direction opposite to the direction of rotation of said loop-taker, and means including a gear in mesh with one of the gears connecting said loop-taker shaft with said actuating shaft for operating said opener-member to oscillate the thread-carrier.

3. A rotary hook mechanism assembly adapted to be detachably secured as a unit to a sewing machine, comprising, a supporting saddle, a rotary hook-shaft journaled in said supporting saddle, a driving gear mounted on said hook-shaft, a rotary hook carried by said hook-shaft, a thread-carrier journaled in said rotary hook, an opener-finger supported on said saddle for movement into and out of engagement with said thread-carrier, and means operatively connecting said hook-shaft to said opener-finger for imparting movement to said opener-finger once only for each two rotations of said rotary hook.

4. A rotary hook mechanism assembly adapted to be detachably secured as a unit to a sewing machine, comprising, a supporting saddle, a rotary hook-shaft journaled in said supporting saddle, a driving gear mounted on said hook-shaft, a rotary hook carried by said hook-shaft, a

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thread-carrier journaled in said rotary hook, an opener-finger supported on said saddle for movement into and out of engagement with said thread-carrier, a rotary opener-shaft journaled in said saddle and operatively connected to said opener-finger, and a gear on said opener-shaft in mesh with the driving gear on said hook-shaft, the ratio between the gear on the opener-shaft and the gear on the hook-shaft being such that the opener-shaft rotates at a speed less than that of the hook-shaft.

5. A rotary hook mechanism assembly adapted to be detachably secured as a unit to a sewing machine, comprising, a supporting saddle, a rotary hook-shaft journaled in said supporting saddle, a driving gear mounted on said hook-shaft, a rotary hook carried by said hook-shaft, a thread-carrier journaled in said rotary hook, an opener-finger supported on said saddle for oscillation into and out of engagement with said thread-carrier, a rotary opener-shaft journaled in said saddle and having a crank-pin, a link connecting said crank-pin to said opener-finger, and a gear on said opener-shaft in mesh with the driving gear on said hook-shaft.

6. A rotary hook mechanism assembly adapted to be detachably secured as a unit to a sewing machine, comprising, a supporting saddle, a rotary hook-shaft journaled in said supporting saddle, a driving gear mounted on said hook-shaft, a rotary hook carried by said hook-shaft, a thread-carrier journaled in said rotary hook, an opener-finger supported on said saddle for movement into and out of engagement with said thread-carrier, a rotary opener-shaft journaled in said saddle and having a crank-pin, a link connecting said crank-pin to said opener-finger, and means connecting said hook-shaft to said opener-shaft for rotating said opener-shaft at a different frequency from the hook-shaft.

7. A rotary hook mechanism assembly adapted to be detachably secured as a unit to a sewing machine, comprising, a supporting saddle having upper and lower spaced walls, a rotary hook-shaft journaled in said spaced walls, a driving gear carried by said hook-shaft between said spaced walls, a rotary hook carried by said hook-shaft, a thread-carrier journaled in said rotary hook, an opener-finger supported on said saddle for movement into and out of engagement with said thread-carrier, a rotary opener-shaft also journaled in the spaced walls of said saddle in substantial parallelism with said hook-shaft, a gear carried on said opener-shaft between said spaced walls and in mesh with the driving gear on said hook-shaft, and means operatively connecting said opener-finger with said opener-shaft.

8. A rotary hook mechanism assembly adapted to be detachably secured as a unit to a sewing machine, comprising, a supporting saddle, a rotary hook-shaft journaled in said supporting saddle, a driving gear mounted on said hook-shaft, a rotary hook carried by said hook-shaft, a thread-case journaled in said rotary hook, a carrier movably supported on said saddle, an opener-finger adjustably secured to said carrier, a rotary opener-shaft journaled in said saddle, means connecting said opener-shaft with said carrier, and means connecting said opener-shaft to said hook-shaft for rotating said opener-shaft at a speed different from the speed of the hook-shaft.

9. A rotary hook mechanism assembly adapted to be detachably secured as a unit to a sewing

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machine, comprising, a supporting saddle having spaced walls defining an oil-chamber, a rotary hook-shaft journaled in said saddle and having a portion thereof disposed in said oil-chamber, a gear mounted on that portion of the hook-shaft within the oil-chamber, a rotary hook carried by said hook-shaft, a thread-carrier journaled in said rotary hook, an opener-finger supported on said saddle for movement into and out of engagement with said thread-carrier, a rotary opener-shaft also journaled in said saddle and having a portion thereof disposed in said oil-chamber, a gear mounted on that portion of the opener-shaft within the oil-chamber and arranged to mesh with the gear on said hook-shaft, and means operatively connecting said opener-finger with said opener-shaft.

10. A rotary hook mechanism assembly adapted to be detachably secured as a unit to a sewing machine, comprising, a supporting saddle, a rotary hook-shaft journaled in said supporting saddle, a driving gear mounted on said hook-shaft, a rotary hook carried by said hook-shaft, a thread-carrier journaled in said rotary hook, an opener-finger pivotally supported on said saddle for movement into and out of engagement with said thread-carrier, a rotary opener-shaft journaled in said saddle and having a crank-pin, a gear on said opener-shaft in mesh with the driving gear on said hook-shaft, and a link pivotally connected at one end to said opener-finger and at its other end to said crank-pin, said opener-shaft and opener-finger support being disposed so that when the opener-finger is in its advanced thread-carrier engaging position the axis of said crank-pin is in substantial alignment with the axis of the opener-shaft and the axis of the connection between the link and the opener-finger.

11. A sewing machine having a frame including a bed and a bracket-arm, a plurality of endwise reciprocatory needles journaled in said bracket-arm, a rotary actuating shaft journaled in said bed, a plurality of loop-taker supporting saddles mounted for adjustment relative to each other lengthwise of said shaft, loop-takers journaled for rotation in said saddles, driving connections with said shaft for rotating each of said loop-takers a plurality of times for each reciprocation of said needles, thread-carriers journaled in and restrained against rotation with the respective loop-takers, an opener-finger movably supported on each of said saddles, said opener-fingers being disposed to engage and to oscillate the respective thread-carriers oppositely to the directions of rotation of the loop-takers, and a separate train of connections entirely sustained by each saddle for operatively connecting each of said opener-fingers to said rotary actuating shaft, said connections being such as to actuate said opener-fingers at the same frequency as the needles reciprocate.

12. A sewing machine loop-taker mechanism, comprising, a rotary hook-shaft, a rotary hook carried by said hook-shaft, a thread-carrier journaled in said rotary hook, a rotary opener-shaft, driving connections with said hook-shaft for rotating said opener-shaft in a continuous direction, an opener-finger mounted for movement into and out of engagement with said thread-carrier, and operative connections with said opener-shaft for actuating said opener-finger.

13. A sewing machine loop-taker mechanism, comprising, a rotary hook-shaft, a rotary hook carried by said hook-shaft, a thread-carrier jour-

naled in said rotary hook, a rotary opener-shaft disposed substantially parallel to said hook-shaft, driving connections with said hook-shaft for rotating said opener-shaft in a continuous direction, an opener-finger mounted for movement into and out of engagement with said thread-carrier, and operative connections with said opener-shaft for actuating said opener-finger.

14. A sewing machine loop-taker mechanism, comprising, a rotary hook-shaft, a rotary hook carried by said hook-shaft, a thread-carrier journaled in said rotary hook, a rotary opener-shaft, driving connections with said hook-shaft for rotating said opener-shaft in a continuous direction at one-half the speed of rotation of said hook-shaft, an opener-finger mounted for movement into and out of engagement with said thread-carrier, and operative connections with said opener-shaft for actuating said opener-finger.

15. A sewing machine having a frame including a work-support and a bracket-arm, an end-wise reciprocatory needle journaled in said bracket-arm, and a loop-taker mechanism complementary to said needle in the formation of

stitches, said loop-taker mechanism including a hook-shaft journaled for rotation about an axis substantially normal to the plane of said work-support, a rotary hook carried by said hook-shaft, a thread-carrier journaled in said rotary hook, a rotary opener-shaft disposed substantially parallel to said hook-shaft, driving connections with said hook-shaft for rotating said opener-shaft in a continuous direction, an opener-finger mounted for movement into and out of engagement with said thread-carrier, and operative connections with said opener-shaft for actuating said opener-finger.

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